

## **ABSTRACT**

The invention relates to a reactor comprising two reaction zones and processes for the production of alkenes from alkanes. A first reaction zone includes a combustion catalyst, and a second reaction zone comprises a heating zone in thermal contact with the first reaction zone. One process comprises generating heat and an effluent by the combustion of a fuel with oxygen in the first reaction zone; passing an alkane feed through the heating zone of the second reaction zone such that the alkane feed absorbs a sufficient amount of the heat generated in the first reaction zone to initiate the conversion of alkanes to alkenes in the second reaction zone. In other embodiments, the effluent comprises oxygen, and the second reaction zone excludes a catalyst; alternatively, the effluent is substantially free of oxygen, and the second reaction zone comprises a supplemental oxygen feed and may or may not include a catalyst.